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CANTON CHRISTIAN COLLEGE

BULLETIN NO. 23

NOTES ON

FARM ANIMALS AND ANIMAL INDUSTRIES IN CHINA

BY

CARL OSCAR LEVINE

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CANTON, CHINA

1919


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Farm Animals and Animal Industries in China

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Preface

With the limited data available on farm animals and animal industries in China, a comprehensive treatise that would do justice to the subject is hardly possible. The notes and data assembled in this monograph are for the purpose of giving to those interested in the problem of food supply and the development of agricultural industries in China a general idea of the value, extent, and management of live-stock production, and of the possible future development of these industries in China.

There has been very little investigational and still less experimental work done in the live-stock industries of China. Investigations and experiments with live-stock were begun at the Canton Christian College in the fall of 1916. While valuable date has been collected during the past three years, the work at the College has only just begun, and similar work in the future should furnish much additional data that will be of value in building up the live-stock industries of the new Republic.

The Japanese authorities in Shantung have made extensive and thorough reports on the following live-stock industries in Shantung: *Shantung Cattle; Shantung Eggs*; *Shantung Wool*; and *Bristles in Shantung*. In this bulletin the writer has made use of some of the data contained in the Japanese reports.

Lack of data on farm animals and animal industries is keenly felt, and such information will be gladly received. Criticisms on the data and suggestions contained in this bulletin are invited.

Introduction

§ 1. CHINESE LITERATURE ON FARM ANIMALS.

There is very little published material on domestic animals in China. The only published material in Chinese that we have been able to secure is a set of four small illustrated pamphlets called Liu Ma Ts'aap (療馬集). This work is a revision made by Hui Cheung (許鏘) sometime between the years 1736 and 1795, during the reign of the Emperor K'in Lung (乾隆). The original was wiriten by two brothers, Yue Poon Hang (喻本亨) and Yue Poon Yuen (喻本元), during the Ming (明) Dynasty.* The two brothers are said to have been experienced veterinarians and judges of live-stock.

In the pamphlets mentioned above the authors discuss briefly the proper management and judging of farm animals. A formula is given for telling the age of a horse by its teeth up to 32 years. The larger part is taken up with descriptions of common ailments and methods of treatment. About two-thirds of the material is poetry in old style charactes and very difficult to translate. Most of the material is on the horse. The buffalo, camel, and cow are treated very briefly. It is interesting to note that while the veterinary part is based mainly on superstition, descriptions of common ailments are well given, and the instructions for judging and caring for live-stock are in general the the same as is followed to-day by intelligent farmers.

§ 2. CLASSES OF FARM ANIMALS IN CHINA

Domesticated animals in China consist chiefly in swine, cattle of both the European and the Asiatic (humped) species, water buffalo, horses, fowl, ducks, geese and pigeons. It the northern provinces the donkey, mule, and camel are also reared. The yak, whose native home is in Tibet, is found to some extent in western provinces, especially in Szechwan. Because of lack of data on the pigeon, donkey, mule, camel and yak, these classes of farm animals will not be discussed in this bulletin.

*The Ming Dynasty was in power from 1368 to 1644 A.D.

Poultry

§ 3. EXTENT OF POULTRY INDUSTRY

The poultry and swine industries are by far the largest of the live-stock industries in China. Nearly every family in the villages in all parts of China raises a few fowls, and many keep one or more brood sows.

Professor King in his well known and interesting book, *Farmers of Forty Centuries*, states that in Japan there are 16,500,000 fowls, or about one for every three persons in that country. The number of fowls raised to maturity in 1912 in the United States was 300,000,000, or three for every person in the land. There are a number of estimates on the number of fowls in China, which vary considerably. It would probably be safe to say that China has one bird for each inhabitant, or 400,000,000. Judging from the number of fowls seen everywhere in China, this estimate is not high. Further, the Chinese are heavy users of poultry and eggs, and probably consume as much per capita as do Americans. In spite of the large consumption the supply not only keeps up with the demand but is enough to permit a fairly large export of poultry and poultry products to other countries. On the other hand, the United States with three fowls for each person imports eggs and poultry in large amounts each year. Bearing this fact in mind, it is evident that the estimated number of 400,000,000 fowls is none too high for China.

§ 4. POULTRY PRODUCTION IN SOUTHERN CHINA

In Honam, a southern suburb of Canton, and in the village of Five-Eye Bridge, three miles west of the Shek Wai T'ong railway station, there are some 15 Chinese incubators. These each hatch from 500 to 12,000 chicks a day, with an average of about 2,800 a day throughout the hatching season of eight months, from March to October, and have a total hatch for the season of about 4,000,000 chicks. Estimating that only one-half grow to maturity, or roasting age, we have nearly 5,000,000 fowls supplied each year to Canton and surrounding villages by the incubator shops. This does not include a large number hatched by hens in the homes of the villagers, which would bring the total up well past the 5,000,000 mark. The Canton-

ese are great lovers of roast chicken and duck and during the winter season kill and roast each day about 10,000 birds. In addition to consuming practically all the locally raised birds, they also buy a large amount of live poultry from Wuchow, and dried and cured poultry from Yunnan Province.

Wuchow on the West River is probably the largest poultry producing center in the south. The customs returns for the years 1915 to 1917 show that after supplying its own local demand that city exports to Macao and Hongkong an average of 2,500,000 birds a year. Yeungkong, Nanking and Hankow are also large poultry producing centers.

§ 5. NUMBER OF EGGS PER HEN AND TOTAL EGG PRODUCTION.

According to the Japanese authorities the average annual production per hen in Shantung in 84 eggs. This is a high average compared with other countries. It is also higher than investigations so far have shown it to be in Canton.

In 1918 the Canton Christian College conducted a production experiment with thirty hens. The hens were of the common mixed variety seen everywhere in the villages of this region. They were given the same feed as is commonly fed to fowls by the villagers. The experiment ran for twelve months. The lowest record was 14 and the highest was 104, the average for all being 72 eggs. The higher production per hen in Shantung Province is probabiy due to the kind of feed given. Beans, whole and cracked, constitute the bulk of the feed in that region. Beans contain a high percentage of protein and make an excellent feed for the production of eggs.

The average number of eggs produced per hen in China is probably nearer 75 than 84. About one in eight of the mature birds is a male. Estimating the number of laying hens in China as 350,000,000, and the average production per hen as 75 eggs, the total number of eggs produced in China each year is 26,250,000,000.

§ 6. VALUE OF POULTRY AND EGGS.

The total value of poultry produced in China each year is not insignificant. Placing the average cost of a mature bird at 50 cents Chinese currency and using this estimate for the total number of birds

gives a total value of $200,000,000. The total value of eggs produced each year, at an average price of one cent each, is $262,250,000.

The estimated total value of poultry and eggs produced each year in China is then about $462,250,000. These figures give us some idea of the extent of the poultry industry in China.

§ 7. EXPORT OF POULTRY AND POULTRY PRODUCTS

Not all the poultry and eggs produced in China are consumed at home. According to the customs reports, the average excess of exports over imports in China for poultry, fresh and frozen eggs, and dried albumen and yolk, during each of the three years from 1915 to 1917, totalled 12,000,000 taels.* Of this total 700,000 taels was for poultry, 2,500,000 taels for fresh eggs, 800,000 taels for frozen eggs, and 8,000,000 taels for dried egg albumen and yolk. The fresh eggs are exported chiefly to Hongkong and Japan, and the dried product goes chiefly to Great Britain, Spain and the United States. Before the war a good deal of the dried product went to Germany. During the war there was an increase in the demand for the dried product. The export in 1917 was valued at 12,000,000 taels as compared with 5,000,000 taels in 1915.

§ 8. BREEDS AND VARIETIES OF FOWL IN CHINA

There are a number of different breeds of fowl native to China, some of which have become very popular in America and Europe. The Swatow breed, of which there are two varieties in China, the White and the Buff, and the Black Langshan, known in China as the Black Shanghai, are some of the Chinese breeds that are common in most parts of the world where attention is given to poultry production. These two breeds are heavy breeds, and are raised especially for meat, although they are also good layers of large eggs. The hens weigh from 4 to 6 pounds and the cocks from 5 to 9 pounds.

Two other distinct native breeds of fowls are the Silky and the Frizzle, known in Cantonese as the Chuk Sz Kai (竹絲雞) and the Ko Mo Kai (高毛雞). Fowls of these two breeds are not very common, the reason given being that they are difficult to raise. They

*A tael (兩) is a monetary unit having a value equivalent to one ounce of silver, or about $1.40 in Chinese currency.

are poor layers. Their meat is considered by the Chinese as having medicinal value, and is eaten for a tonic. The skin of the Silky is dark blue, and a thin, black film surrounds the bone. In both these breeds the bill and the exposed skin on the heads, feet and legs, are deep blue. The Silkies have downy feathers, white being the most common color. The Frizzles are black and have curly feathers. These two breeds usually sell for twice the price of ordinary fowls.

§ 9. BREEDS OF FOWL IN SHANTUNG

The Japanese report on Shantung eggs says of the fowls of that region:

> "There are many kinds of chickens in Shantung Province, but the greater number of them are the Langshan and next to the Langshan are the Cochin, Brahma, and the Leghorn. The Germans desired to improve the domestic fowls of Shantung and introduced birds from America of the Orphington and Wyandotte varieties. They considered those breeds most suited to the geography of that region. As a result there are to-day a large number of mixed breeds in Shantung."

§ 10. "CANTONESE" BREED

The buff colored fowl is the most common in South China. This fowl is called in Cantonese "Wong Kai" (黃雞) or Yellow Fowl. In the Philippines, where this breed has become very popular, it is called the "Cantonese" breed. This breed was considered of sufficient importance in the Philippine Islands to warrant the sending of Mr. Jos. Cocannoeur of the Philippine Bureau of Education in September, 1914, to Canton to secure especially selected birds. Mr. Cocanneur made his headquarters at the Canton Christian College and was given assistance by the College in locating the birds. The fact that the "Cantonese" breed is to-day the most important breed of fowl in the Islands is due largely to Mr. Cocanneur's introduction. Hens of this breed were used in the production experiment made by the Canton Christian College. In China it is very popular both for egg laying and meat, and is the utility breed of South China. Mature birds weigh from 2 to 4 pounds each. Nine and one-fourth eggs are required to weigh one pound. It is the custom to made capons out of all male chicks not used for breeding or egg laying purposes and excellent capons weighing from 4 to 5 pounds at 6 to 8 months are secured.

As is inferred from the name in Chinese, the characteristic color of this breed is yellow, or more accurately, buff. The color of the males is usually darker than that of the hens, and frequently like that of the Rhode Island Red. Because of the fact that these fowls are permitted to mix with Frizzles, Silkies, and other breeds, it is almost impossible to know with certainty which birds are pure, and which have in them recessive characters of the black Frizzles, and the white Silkies. Fortunately, in the region of Canton, birds of these breeds are not numerous compared with the Cantonese buff breed. Although the proportion of other breeds to the Cantonese is small, the amount of "off color" in the offspring of buff colored hens and males is quite large. As a rule, out of 100 chicks 50 to 70 are of the proper color and type. The others are badly mixed.

§ 11. METHODS OF RAISING FOWLS

Although nearly every family raises a few chickens, there are no poultry breeders in southern China. Chicks are hatched by setting hens, or purchased from incubator shops. In the villages the chickens are allowed freedom of the streets. Often the birds are marked with paint in order that the owner can better keep track of them. Because of the absence of breeders to keep up the pure breeds, it is very difficult to get pure individuals of any breed.

One male is usually kept for every eight or ten hens. All other males are caponized when a few weeks old.

To break a broody hen from her desire to sit a small feather is is run through the nostrils. This worries her and keeps her restless. In a few days she forgets her desire to sit and the feather may then be removed.

§ 12. FEED

The usual feed in south China for both small chicks and mature hens is cooked rice chop, and wheat and rice bran, fed in a mash. Insects, such as "June bugs," grasshoppers, and caterpillars, are also fed. Sometimes when the village farmer goes to work in the fields he takes with him a hen and her small chickens and turns them loose in the field to feed on insects among the growing plants.

When chicks are about five or six months old they are often sold to feeding shops, where they are confined in bamboo crates and heavily fed on fattening food, chiefly cooked rice chop and wheat bran.

§ 13. PRICES

Prices vary considerably throughout the year. At Canton fattened birds usually sell for about 30 cents local currency a pound. Fresh eggs sell for about 2 cents each. These prices are considerably higher than prices in central and north China. Rice chop varies in price from 3 to 6 cents, and wheat and rice bran from 3.25 to 5.5 cents local currency, a pound.

§ 14. CAPONIZING

Caponizing is universally practiced in China. Experts travel about from village to village and do the work for a small consideration, usually for 2 coppers a bird. The operation is generally performed when the cockerel is about two months old. Instruments somewhat similar to those used in America, though cruder, are used. Capons of the common Cantonese fowl weigh from 4 to 6 pounds each when 6 or 8 months old. They usually sell for a few cents a pound less than do cockerels or pullets, probably because they are more efficient feeders and the cost of raising them is not so great.

§ 15. DUCKS AND GEESE

Ducks and geese are raised in large numbers in many part of China. The numerous waterways, both natural and artificial, afford ideal conditions and cheap feeding for these classes of poultry. While there is no recognized breed of ducks in southern China, the White Peking duck of northern China has become established the world over as the best variety of meat duck, and in America it is the most popular breed for that purpose. It was introduced into England in 1873 and reached the United States the following year.

In the region of Canton and most parts of southern China the common duck is a small dark grey, or white and grey bird, weighing from 3 to 5 pounds. It is a very good eating duck, and is very popular fresh, roasted, and dried. In the Lin Chow district, which is

in the northern part of Kwangtung, there is a duck which weighs from 6 to 10 pounds. Ducks of this breed are very good layers, and the meat is said to be excellent. They are dark grey in color.

Two of the world's best varieties of geese, the Chinese White and the Chinese Brown, have their origin in China. To-day they are found in parts of China, America, and England. The Chinese geese are the most beautiful of all varieties of geese. For ornamenting the lakes and lagoons of public and private parks they are in great demand in western countries. They are a practical variety, outrivaling other breeds and varieties in egg production. Their bodies are plump and round and their meat is of excellent quality. They produce a good quality of feathers and down. They are medium in size, mature specimens weighing from 10 to 14 pounds. In general appearance these Chinese geese have long necks, carried very upright, with a large orange-colored round knob or protuberance on top of the bill at its base. In the south a small grey variety is common. It is not as ornamental as are the white and the ~~grey~~ brown varieties, but has meat of good quality. The protuberance on the base of the bill is black in this variety.

§ 16. DISEASES AND PARASITES OF POULTRY

Little is known about diseases of poultry in China. A common disease occurring among fowls in the region of Canton, usually every spring, is no doubt the roupe common in America and Europe. A form of cholera or plague which kills large numbers of fowls each year is also common. Contagious diseases occur among the ducks, especially in the spring during the duck-raising season, when in the larger flocks ducks die by the hundreds in a short time. What appears to be white diarrhœa is also found here.

External parasites, however, such as the mite, head louse, body louse, and the chigger, common everywhere in America and England, and against which poultry men in those countries must constantly fight, are not so prevalent in southern China. For how much of China this is true, we do not know. Out of those mentioned above only the pale yellow body louse, *Menopon pallidum,* is found among the native fowl of the region about Canton. If the mite, head louse, and chigger ever get started here it will be serious blow to the poultry industry,

especially to raising fowl, for which class of poultry the parasites have a preference. Great care should be taken in importing poultry from other countries and provinces not to introduce any of these parasites into the south. Every bird introduced here should be thoroughly disinfected with insect powder, and the crate in which it is shipped should be burned on its arrival, or thoroughly saturated in a strong solution of a coal tar disinfectant.

REFERENCES AND BIBLIOGRAPHY ON POULTRY

Chinese Customs Reports.

King, *Farmers of Forty Centuries*, pp. 3, 83, 130, 180, 181, 205, and 233.

Report of Investigations by Japanese Military Authorities in Tsingtau, *Shantung Eggs*.

Bailey, *Cyclopedia of American Agriculture*, vol. III, pp. 570 and 573.

Chinese Incubators

The Chinese method of incubating eggs is economical and efficient when it is desired to produce chicks in larger numbers, and it is strange that the method with some improvements and modifications has not been adopted for the hatching of eggs on a commercial scale in other countries. Some chicks are hatched in the natural way under hens, but by far the larger number are hatched in large incubator shops throughout the country.

Canton, Wuchow, Hankow, and Shanghai are probably the largest incubator centers in China. In Honam, a southern suburb of Canton, there are eight of these shops, some with incubating capacities of from 50,000 to 200,000 eggs at one time.

§ 17. METHOD OF HEATING THE EGGS

The methods for applying heat in the incubators are similar to those used by the Egyptians four thousand years ago, ruins of whose incubators still exist in the Nile valley.

On the first day the eggs are thoroughly warmed to the proper incubating temperature, 103 degrees Fahr., or a little less. This is accomplished by placing the eggs in a brick, oven-like room, usually abont six feet deep, twelve feet long and ten feet high. The eggs are placed in baskets arranged on shelves around the walls of this room , each basket holding two or three hundred eggs. As many as forty of these baskets in the larger shops may be found in the oven or heating room at the same time. Heat is furnished by burning charcoal in earthenware pots placed on the floor of the room.

Sometimes baskets of eggs are placed in large stone jars and a slow charcoal fire is kept burning continuously against the outside of the jar, or underneath it throughout the entire incubation period. This latter method is largely used at Shanghai and Hankow and other places further north, where the climate is cooler and constant application of heat is necessary throughout part of the hatching season.

Another method used in Honam is to place the eggs on the roof of the shop in warm sunlight until they are thoroughly heated through to the right temperature.

§ 18. HANDLING THE EGGS AFTER HEATING

After the eggs have been heated to the proper temperature, either in the oven, or in the sun, they are placed in cylindrical baskets, about 30 inches deep and 24 inches in diameter. Each basket holds about 1,000 eggs. The walls of the basket are about one and one-quarter inches thick. They are made of firmly packed rice straw. The straw is held in place with wicker or bamboo on both the inside and the outside. The baskets are lined with a heavy grey paper, somewhat like asbestos. The paper and the basket are thoroughly warmed before the eggs are placed in the basket, where they are arranged in layers one egg deep, the layers being separated by a piece of cloth. Twice a day the eggs are changed from one basket to another. The operator simply collects the four corners of the square piece of cloth in one hand and transfers it with the eggs to another basket. This is done with each layer of eggs in the basket. In performing this operation the eggs naturally tumble together in a heap in the center of the cloth and again roll out in a single layer. This method takes the place of the slow method of turning eggs used with modern incubators, and is most efficient, as the eggs are turned in about one-tenth the time required in using the ordinary modern incubators. Transferring the eggs from one basket to another by this method also gives the airing necessary for the production of strong, healthy chicks.

The eggs are usually kept in the baskets until about the fourteenth day, when they are transferred to large trays, about 6 feet wide, 18 feet long and 3 inches deep. Each tray holds about 10,000 eggs. The bottom of the tray is lined with the same heavy paper with which the baskets are lined. The eggs are also covered with this paper, or with blankets. The amount of covering depends, of course, on the weather and the period of incubation. In warm weather no covers are needed during the last two or three days of incubation. Just before they hatch, the numbers of eggs in the trays ~~are~~ reduced to one layer. One end of the tray is left empty for about two feet of its length and twice a day the eggs are turned or rolled by being pushed, several dozen at a time, toward the empty end.

§ 19. CANDLING

The eggs are candled twice, usually on the third and seventh days. All infertile eggs are sold, so there is minimum of loss through unhatched eggs.

§ 20. REGULATING THE TEMPERATURE

Throughout the incubation period careful watch is kept over the temperature. No thermometer is used, but the operator raises the lid, or a blanket, removes an egg and presses the large end against a closed eyelid where the skin is very sensitive to temperature. Long practice has taught them to judge differences in temperature quickly and accurately. The men sleep in the room with the eggs, or in adjoining rooms. Some one is on duty constantly, examining and regulating each individual basket or tray according to its individual deeds through the management of doors or the shifting of blankets.

As soon as the chicks hatch, they are placed in circular bamboo trays about three feet in diameter and eight inches deep. They are ready for sales as soon as they are dry

§ 21. HATCHING PERCENTAGE

The hatching percentage usually runs about 75 per cent. for fertile fowl eggs and about 90 per cent. for fertile duck eggs.

This average hatch is fair, and with better sanitation, ventilation, construction of buildings so as better to regulate the heat, and with the use of thermometers, it is the opinion of the writer that this method of hatching eggs on large scale would be far more economical and efficient than hatching chicks on a large scale in our so-called modern incubators.

§ 22. PRICES FOR AND DISPOSAL OF CHICKS

In Canton the eggs are usually purchased by the incubator shops at two cents each and the chicks and ducklings are sold at from four to six cents each, the price depending on the demand and the season. The chicks and ducklings are usually contracted for in large lots by chicken dealers and large duck feeders. Large chicken feeding farms

are not common, but there are many duck farms on Honam Island that feed from 5,000 to 50,000 ducks at one time. The ducks are purchased when about a day old in lots up to 40,000 from the commercial incubators and fed for about 100 days, when they are sold in the Canton markets.

REFERENCES AND BIBLIOGRAPHY ON CHINESE INCUBATORS

King, *Farmers of Forty Centuries*, p. 177.

Hull in *Seventeenth Annual Report of U. S. Bureau of Animal Industry*, (1900), p. 247.

Bailey, *Cyclopedia of American Agriculture*, vol. III, p. 542.

Swine

§ 23. EXTENT AND VALUE OF SWINE INDUSTRY

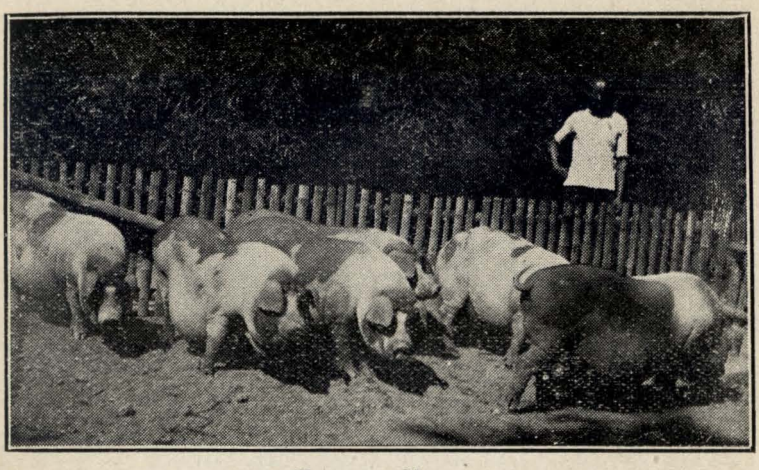
Of the farm animals in China next in importance to poultry is the pig. Professor King estimated the number of pigs raised each year in Shantung as one for each inhabitant, or about 25,000,000. A conservative estimate of the number of pigs raised in China each year would be 100,000,000. At the low estimate of Mex. $12 each the annual pig crop would have a value of Mex. $1,200,000,000 The average annual export of swine exceeded the imports for the years 1915 to 1917 to the amount of 2,300,000 taels. Most of the hogs exported went to Hongkong and Russia. A large part of the hogs which go to Hongkong are converted into lard and shipped to Liverpool.

§ 24. BRISTLES

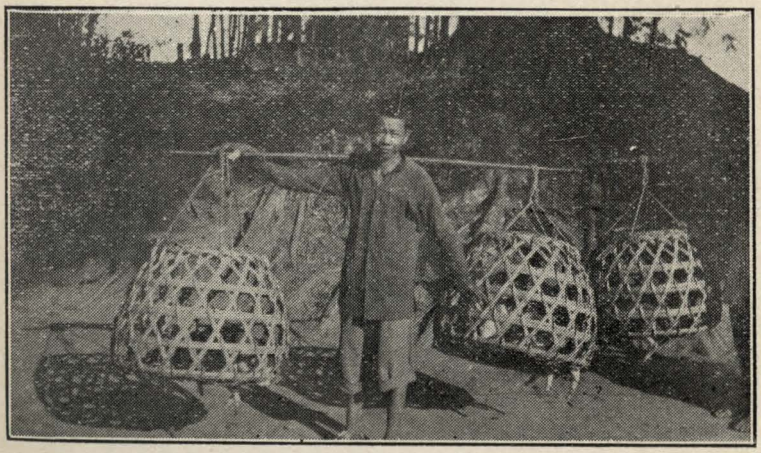
The sale of bristles for brushes, a by-product of the swine industry, is quite large. Shantung province, which has the largest export in bristles of any region in China, exports annually about 500,000 pounds. The prices paid by exporters for sorted, cleaned, and dried bristles varies from Mex. $20 to $220 for 100 pounds.

§ 25. DESCRIPTION OF CHINESE LARD HOGS

Hogs in different parts of China vary considerably in type, but in general there are two types. In most parts of the south are found the common sway-backed village hogs. They range in color from nearly all white to black, or black with white points. They are of the fat or lard type. Their meat is of good quality and cures fairly well. They are fine-boned, and smooth. Hogs with wrinkled sides are seldom seen. They are slow in maturing. Twelve hogs at the Canton Christian College in 1917 made an average gain at six months of age of about .65 pounds a day on full feed. When one year old they usually weigh from 200 to 250 pounds. The average dressing per cent. of 32 hogs butchered at the Canton Christian College in 1917 and 1918 was 72.5 per cent. The chief objection to this hog is its low back, scant hams, large belly, and weak pasterns, which easily break down in the animal that is being fattened.



CHINESE HOGS
RAISED ON CANTON CHRISTIAN COLLEGE FARM



A CHINESE METHOD OF CARRYING A
LITTER OF SMALL PIGS

§ 26. METHOD OF RAISING THE PIGS

Most farmers who raise hogs keep from one to five or six brood sows. The litters are large. A sow is supposed to be able to nurse at least ten pigs, which seems to be the average number in the Canton region, although as many as fifteen are frequently seen with one sow.

During the day the sow and pigs roam at will in the narrow stone streets of the villages picking up what edible garbage they can find.

A sow is sometimes muzzled when she is turned out with her family of pigs.

§ 27. CASTRATING AND SPAYING

Pigs are usually castrated and spayed when they are six to ten weeks old, and still sucking, although animals weighing as much as 100 pounds are sometimes thus operated on. The Chinese consider it just as necessary to spay gilts as to castrate boars. Meat from unspayed gilts is somewhat coarser than that from spayed animals, and better growth is also obtained by spaying.

Both operations are arts practiced by only a few experts. Spaying in never attempted by the farmer himself, and castration only when the services of the expert cannot be secured. A professional usually has an apprentice to assist in holding the pigs during the operation. The apprentice after a time performs the operations himself and becomes an expert, provided he can work rapidly enough. Castration is accomplished in the same way as in Western countries. Spaying, however, is somewhat different.

In spaying the assistant holds the pig by the hind legs, one leg in each hand, with the rear end of the pig uppermost and its back resting on the rounded top of a bamboo pig-carrying crate. The operator locates the ovary by pressing with his thumb in the region of the ovary, half way between the last teat and the inner side of the hind leg. With a sharp steel scalpel an incision is then made in the region over the ovary, clear through to the abdominal cavity. The cut in a fifty pound pig is never made more than an inch and a quarter long, and is always made parallel to the long axis of the body. The other end of the scalpel is then quickly inserted in the incision and a loop of the small

intestine is drawn out until the ovary and uterus appear. These are drawn out far enough so that they can readily be severed from their attachments. As much as two feet of the intestine is sometimes withdrawn before the ovary and uterus appear.

As soon as the organs have been removed, the intestine is stuffed back through the incision. The other ovary is located and removed from the other side in the same way. The incisions are not sewed up after the operation.

Sucking pigs are castrated and spayed by the litter. The usual price in the region of Canton is 30 cents local currency a litter. A litter of ten can be operated on with the aid of one assistant in less than 30 minutes , providing the pigs are all ready at hand in baskets. Spaying larger gilts takes more time, but must be done very quickly, for if the intestines remain exposed as much as five minutes, inflammation sets in, indicated by the color of the intestines becoming dark, and the animal is usually lost. Very few losses occur, however, and most losses are due to delay in locating the ovary or delay in finding the proper part of the intestine with the handle end of the scalpel so it can be withdrawn.

No disinfectants are used, nor is the operator particular about the pig, or his own hands, being clean. No doubt many of the few losses which do occur are due to this lack of sanitary precautions on the part of the operator, and because of the fact that feed is not reduced either before or after the operation.

In the fall of 1918 the service of a local hog "veterinarian", if he may be properly referred to as such, was secured by the College, and four gilts weighing about 40 pounds each were spayed. The operator was allowed to use his own methods No disinfectants were used, nor was the amount of feed reduced, either before or after the operation. The operations were succesful in every case. Very little discomfort was shown by the pigs after the operation, and they did not get "off feed".

The Chinese method of spaying is a good one, although is requires more expert work than does the method used in America, where the ovary is removed from the flank of the animal through an incision large enough to permit inserting the hand in order to locate and remove the ovary. With an expert rapid operator, and the use of disinfect-

ants, there is no doubt but that the Chinese is the better of the two methods.

§ 28. HOG FEEDING PLANTS IN CONNECTION WITH DISTILLERIES

Hog feeding plants, feeding from 100 to 300 hogs at a time, are usually found in connection with rice wine distilleries. Sheung Yuen (嘗源) on Sin Chung Taai Street (洗涌大街) in Honam, south of Canton, is a representative plant of this kind. This is a rice wine distillery, with a hog feeding plant run in connection with it. The writer visited the plant on November 2, 1918. At that time about 200 hogs were being fed, which was the full capacity of the plant. No brood sows are kept, but pigs weighing about 50* catties each are purchased from the village farmers. Brewer's grains from the distillery form the largest part of the ration fed, although some rice and wheat bran is also fed. About 600 catties of dry feed are required to make 100 catties of gain in weight in this plant. The hogs are fed for from 200 to 250 days, and when sold weigh from 140 to 200 catties. The size of the hogs when sold and the length of the feeding period depend on the individual hogs and on the market prices and demands.

The prices paid for rice chop varies from $3 to $4 local silver currency for 100 catties. Brewer's grains sell at 40 cents for 100 catties. Manure from the plant sells at 30 cents for 100 catties. The price received for the hogs on the market is variable. The average price during the years from 1916 to 1918 war $20 local silver for 100 catties, and the market price varied from $16 to $24.

The prices paid for market hogs depend on the size, condition, and the demand at different seasons. Hogs weighing about 150 catties generally bring the best prices, and the prices are usually higher during the winter than at other times of the year. Stags and sows, even when fat and in good condition, sell for about three-fourths the price of good barrows and spayed gilts. Unspayed gilts also sell at a cut price.

The hogs in the plant described above are kept in a brick building across the street from the brewery. They are all kept in one room, about 30 feet wide and 80 feet long. Pens are arranged along the sides of the room. These pens are 12 feet square. Ten to

* A catty (斤) is a Chinese unit of weight equivalent to 1⅓ pounds avoirdupois.

fourteen hogs are kept in each pen. A pen of hogs usually represents one litter. An alley about six feet wide runs the length of the room between the pens. The floor of the entire room is paved with brick tile in such a way that the floor slopes from the pens to the alley way, on either side of which is a gutter which carries the washings into the sewer. The floor is kept very clean, as it is washed twice a day, and the pigs themselves get washed in the process of washing out the pens. The solid manure is cleaned from the pens before each washing and stored in a brick and concrete tank at the end of the room where it remains until it is removed by buyers.

§ 29. FEEDS FOR VILLAGE PIGS

Three times a day the village sow and pigs are fed a mixture of a cheap grade of rice chop and rice or wheat bran about half and half. Wheat bran is considered a better fed than rice bran, but is usually higher in price. In the vicinity of breweries, brewer's grains, a by-product of the rice wine industry, form a part of the ration. Vegetables and green cut grasses are also fed. The rice is always fed cooked. The other feeds are fed uncooked. In regions where corn is as cheap and available as rice, it furnishes the main fattening part of the ration. At night the hogs are enclosed in a room usually adjacent to that of the owner's living quarters. The floor is generally paved with tile or brick. Sometimes a corner in the living rooms is fenced off for the sow and her family. The floor is usually kept very clean.

From the time they begin to eat the pigs are given all their feed in the form of a very wet swill. Three times a day they are allowed to drink all they can hold of this feed which permanently enlarges the belly, and tends to pull the animals down in the back. By proper feeding and intelligent selection of breeding stock of the best type, these two undesirable characteristics, sway-back and pot-belly, could be remedied.

The average hog in China is raised on as clean food as is the hog in America. It is not a scavenger like the native hogs in Japan, India and the Philippine Islands, and it is fairly free from diseases, except for hog cholera, which is very prevalent. It is never fed behind cattle, as is the common practice in the corn belt and steer-feeding sections of America.

§ 30. HANDLING OF FRESH MEAT

About 1,000 hogs are killed every day in small Canton butcher shops. The hogs are butchered early in the morning in small slaughter-houses and delivered immediately to the retail shops. In some shops the hogs are butchered in the rear of the retail store, which opens directly on the street.

§ 31. "WATERED" MEAT

Dishonest butchers who do not mind putting their reputation at stake have an interesting method of injecting water into hogs just after they have been killed and bled. The water is forced in through the vena cava. The carcass of a hog may be increased several pounds by thus "watering" the meat. It is difficult to detect such meat until it is eaten. It has a poor flavor compared with normal meat, and will not cure well. This practice is so general that it is difficult to secure pork in Canton which has not been treated thus.

§ 32. HOG CHOLERA

Among the diseases of swine, hog cholera, known in England as swine plague, and in China as Chue Waan (猪瘟), common in all parts of the world where pigs are raised, is prevalent in all parts of China. It is estimated that this disease alone causes more loss to live-stock raisers throughout the world than any other one disease. During the months of March, April, and May, it is most prevalent in south China. In the delta region of Canton about 40 per cent. of the spring crop of pigs die each year, or are marketed because of this wide-spread disease.

The farmers recognize the disease by the characteristic deep red or reddish-purple spots on the abdomen, gummy eyes, spotted kidneys, and inflamed intestines. These are the common symptoms in this region. It is usually accompanied by a high fever. Some hogs of which the writer took the temperature in the spring of 1917 had a temperature as high as 107 degrees Fahr.

Cholera is an intestinal disease, caused by an extremely microscopic organism. The Chinese have learned by experience that there is no cure for the disease and know that it is very infectious. It usually

proves fatal. Experienced veterinarians and laboratories for the production of vaccine for the prevention of the disease are sorely needed. If Canton should pass a law prohibiting sick animals from being sold for food in Canton, and enforce it, would go very hard with the hog industry. This would have been the case America in 1906 when the national pure food laws were passed. providing for government inspection of all carcasses to be sold for food, if cholera vaccine had not been available.

Keeping brood sows to an extreme old age, or until they become sterile, is probably the salvation of the hog industry in China. Such sows have either had mild attacks of cholera when young and have become immune, or are highly resistant to the disease, for according to the village farmers very seldom does a sow more than three years old get the disease. Further study is necessary to determine the extent of this natural or acquired immunity. Evidently it is quite common, for none of the old sows observed in the villages surrounding Canton, where cholera rages nearly every year, have any of the appearances common to hogs that have recovered from a severe case of cholera.

§ 33. TUBERCULOSIS

Tuberculosis, a disease which is quite common among hogs and other live-stock in America and Europe, is unknown among the swine in southern China. According Dr. Adam Gibson, who has been the Colonial Veterinarian of Hongkong for thirteen years, among the thousands of hogs whose carcasses he has examined in the government slaughter house, he has not seen a single case of tuberculosis lesions in the native hog. This is indeed fortunate, for this is one of the few diseases in animals which we dread, not only because of the effect of the disease on the hog itself, but because of the possibility of its being transmitted to man. We do not know whether the absence of this disease is due to the climate or to a natural resistance in the native hogs.

§ 34. PARASITES

Fewer internal parasites are common in the native hogs than one would expect. A number of tape-worm cysts have been found in nearly every hog we have butchered at the College during the past

three years, but according to C. W. Howard, Professor of Biology in the Canton Christian College, they are not the cysts of the tape-worm that is found in man. Dr. Gibson says he also has not yet found the cyst of the human tape-worm in the native hog. Here again we in China are fortunate and great care should be taken to prevent the introduction of this parasite.

Kidney worms and liver flukes, usually common in hogs, have not been found in the hogs of this region. A skin disease in the form of a pox, the nature of which we have not yet determined, is very common. It does not, however, seem to be a serious disease. As a whole, except for cholera, the native hog in south China is a fairly healthy animal.

§ 35. YUNNAN HOGS

In the hilly and wooded regions of the western provinces of Yunnan and Szechwan the type of hog chiefly raised is the bacan hog. This hog makes good cured meat. According to Dr. Gibson, attempts so far to raise it in Hongkong have shown that it cannot compete with the common lard hog in efficiency of utilizing feed. The Yunnan ham, found in the Canton and Hongkong shops and in other parts of China, and exported to the Philippine Islands, is well known in all parts of China because of its excellent qualities.

§ 36. BREEDING OF SWINE

One has only to study the breeding stock in the villages about Canton to realize that the average village farmer knows very little about the breeding of animals. Some of the sows are fairly good individuals, but the boars are usually very inferior. About the only good thing that can be said about the boars is that they are sure breeders, and very prolific. The prevalent idea is that any animal is good enough for breeding. Often the poorest male is reserved for stud purposes. From the time he is weaned he is kept tied with a sort of rope harness fitted around his neck and chest. He is lead about from village to village by his owner as there is demand for his services. On Honam Island one boar is used for from 200 to 300 sows. Two services are allowed in a day, always in the morning. The boars are always undersized, thin, gaunt and weak-looking, probably because of

the fact that they are overworked and underfed. They are unusually gentle and do not have the vicious temperament so commonly seen in boars of improved modern breeds.

§ 37. MODERN BREEDS OF HOGS IN CHINA

Modern breeds of hogs have not yet been introduced to any extent into China. The Hongkong Dairy Farm has done considerable experimenting with different breeds, and now use the Mid-Yorkshire hog of England almost exclusively, both pure and in crossing with the native hogs. They usually have on hand from 600 to 900 of this breed of hogs.

The Berkshire hog, an English breed whose early development was brought about largely through the use of Chinese and Siamese blood, may prove a success in this climate, as it has in the Philippine Islands. There all other breeds up to the present have been little more than failures, due largely to the readiness with which they succumb to the kidney worm. The Berkshire seems to able to resist the kidney worm better than any other of the modern breeds of hogs. However, as the kidney worm does not seem to be common here, other breeds may also prove a success.

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Sheep and Goats

§ 38. FAT-TAIL SHEEP

Sheep of the fat-tailed, hornless variety, which is supposed to have originated in Afghanistan, are found in nearly all parts of north China, but especially in the provinces of Shantung and Chihli. These sheep are so named because of their large tail, which carries a large amount of fat. The tail is usually eight to ten inches long, six inches wide, and three inches thick. It serves as a store for food, and in seasons of drought and scarcity of feed the fat it contains is used up in the body.

An interesting fact in regard to this sheep is that after a few generations of rich feeding in land where nourishing feed is more available, the size of the tail is said to diminish, gradually approaching the size common in other breeds of sheep.

§ 39. WOOL

The fat-tail sheep produce fair wool, though it is inferior in both quantity and quality when compared with modern breeds of wool sheep. According to the Japanese investigators, in 1916 the annual amount of wool produced in Shantung amounted to 30,000,000 pounds. Most of the wool produced in this region is sold to Japan about 20 taels a picul,* the annual sales amounting to 6,000,000 taels. The Japanese use most of the wool for making clothing for the soldiers. It is estimated that each sheep will yield in one year with two shearings four catties of wool. At this rate the total number of sheep in Shantung must be at least 7,500,000. The customs authorities give a value of 5 taels a head for sheep. The mature sheep alone in Shantung at this rate have an annual value of 35,000,000 taels.

§ 40. GOATS

The native black and white goat of China is raised for meat only. In Shantung a Swiss breed of milk goats, known as the Saanen goat, has been introduced by the Germans, and seems to thrive well in that region. Indians have brought with them to Hongkong an Indian breed of milk goat which is doing well so far as it has been tried.

*A picul=100 catties or 133⅓ lbs. avoirdupois.

§ 41. SHEEP AND GOATS IN SOUTHERN CHINA

Canton imports from the north 8,000 fat-tail sheep, and 4,000 meat goats for slaughter each year, or at the rate of 30 a day. Hongkong also imports in large numbers from the north. Goats of the meat breed are raised to a small extent in south China but no sheep are raised in the southern provinces. Dr. Adam Gibson, Colonial Veterinarian in Hongkong, informs us that attempts to raise sheep in south China have failed because of the readiness with which they become infested with the liver fluke. Goats butchered at the College in 1917 were found to be badly infested with this parasite, but evidently the effect on goats is not as serious as is the case with sheep.

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Horses, Donkeys and Mules

§ 42. CHINESE PONY

Horses, donkeys, and mules have been little used, except in the northern and western provinces, where they are used almost solely as pack animals and for riding. Along the southwestern and western borders of China and Tibet is the native home of the Chinese pony, which in literature is referred to as the Tibetan pony. Up to the present no horses have been raised in Kwangtung. Horses from the western provinces are shipped to Kwangtung chiefly from Yunnan.

The Chinese, or Tibetan pony, is an excellent pony for this region. It thrives well in this climate, and its size—it usually weighs about 500 pounds—is well suited to the narrow roads and "coffin-board" bridges. It is a beautiful animal, and the better ones are intelligent and easily trained by one who understands horses, if they have not been spoiled by improper handling. They have good enduring powers, and seem quite free from diseases and unsoundnesses. The color may be any of those common to horses: black, white, sorrel, dun, bay, piebald, gray, white, and iron gray. Bay predominates.

§ 43. THE MONGOLIAN HORSE

The Mongolian horse is quite common in the north. It is considerably larger than the Chinese pony, weighing from 700 to 800 pounds, or more. It is of interest to students of horse breeding because of the fact that it is supposed to be the ancestor of most of our modern breeds of horses. It is raised in Mongolia in a semi-wild manner, much as the mustangs or Indian ponies were raised in the United States on the western plains up to recent years. It is a strong and swift horse, and is said to be fairly free from diseases but it does not do well in the south. As a rule, is not as handsome a horse as the Chinese pony. It usually has a full face, a large head, coarse hones, and a very sloping croup. It is the horse that is used in the annual races of Shanghai and Hongkong. It is not very popular in Canton, where there are only about 50 Mongolian horses, compared with about 250 Chinese ponies.

44 HORSES IN CANTON

While the number of horses in Canton is at present small, the demand for horses for riding and carriage use in Canton is rapidly increasing. Some of the livery barns have recently imported mares from the western part of China and have begun to raise ponies in Canton. There are few mares in Canton other than those recently imported for breeding purposes. The males are seldom castrated.

As a rule the Cantonese are good horse feeders, keeping their animals in good condition, but as yet few know how to ride properly or otherwise to manage horses.

45. FEED FOR HORSES

The usual concentrated feed for horses in Canton is corn, rice chop, and wheat bran. Green grass and rice straw are fed as roughness. The grass and straw are usually cut in short lengths before feeding. The rice is always cooked for the horses.

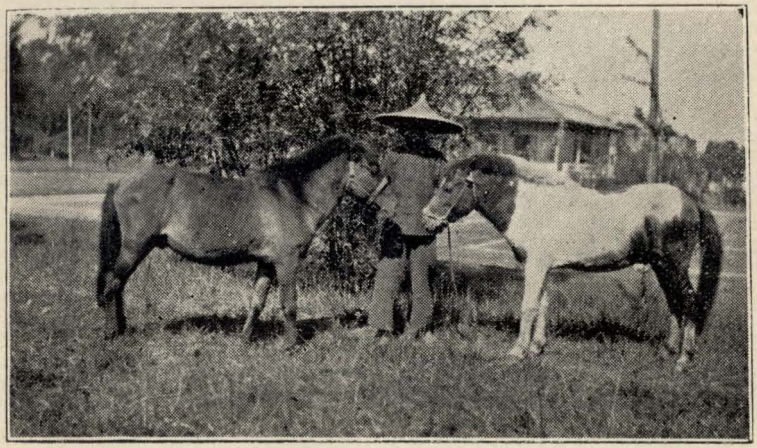
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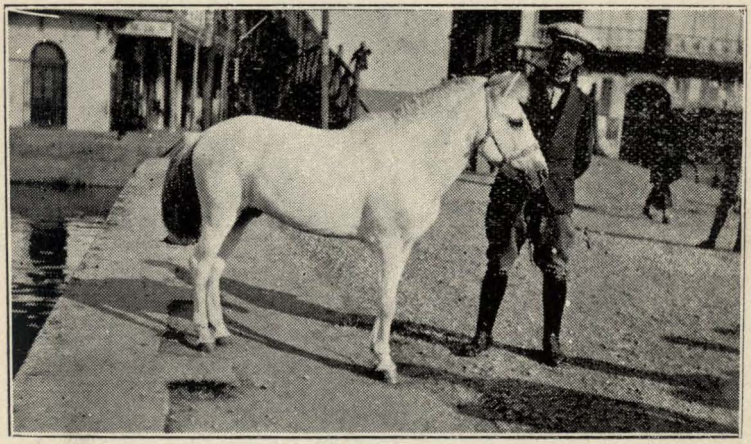
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CHINESE PONIES



~~A MONGOLIAN HORSE~~

Cattle

§ 46. NUMBER AND VALUE OF CATTLE

Shantung, Chihli and Hunan provinces in the north, and Szechwan, Yunnan and Kwangsi provinces in the south-west, produce cattle in largest numbers. Conservative estimates place the number of native cattle at 50,000,000. The total value of these at Mex. $30 a head would be $1,500,000,000. The export of cattle from China to other countries is small but is increasing from year to year. Accord- to the customs reports it has increased from 1,000 to nearly 100,000 head a year during the past four years.

§ 47. SHANTUNG CATTLE

Shantung is one of the leading cattle producing provinces in China. The Japanese authorities report as follows on the cattle in that region:

> Generally speaking the Shantung cattle are large in build. As for the ox, it usually weighs from 600 catties to 1,000 catties, with well developed loins, and legs which almost form a rectangle shape. According to a native, a German missionary once imported here cows of a foreign breed with which he undertook the improvement of cattle in this locality and that was the foundation of our cattle of the present day. - - - Judging from the fact that the Shantung cattle have a comparatively thin hide and have a tendency to early growth and fattening, we can safely infer that they are not a pure breed but improved species. Most cattle now in Shantung were brought over from Honan. Although they are called Shantung cattle there is no doubt but that they are the product of Central China. That is to say, they have gradually migrated eastward from Honan, Shensi, Shansi and Kansu, which are situated in the center of continental China. The Yellow River, which passes through these territories, makes the vicinity of its water course unfit for cultivation by the tremendous overflow of the river which takes place every year. In consequence the district forms one vast pasture of thick weeds (and grass). Any person going through there will notice the thriving industry of cattle raising. As explained above the territories from which Shantung cattle come cover vast areas and naturally the number of cattle available may be said to be almost limitless.
>
> The method of raising cattle is very simple. In the country districts it is not uncommon that there are from 30 to 60 head in one small village. Every farmer usually keeps from five to six head which are usually taken care of by one coolie. When cattle are not employed

they are turned loose on the fields where they feed as they like. The coolie usually is a young lad who is called 'cattle watcher'. His wage is usually 5 to 6 sen per day. At night he sleeps in the cattle shed. Cattle are fed three times a day, morning, noon, and evening during the busiest season of farming. In seasons when farming is not in full swing they are fed twice a day, in the morning and evening. The feed then consists of about 16 catties of straw and 4 catties of mixed feed a day. The straw fed is mostly millet, but wheat straw is fed also. In some places dry peanut stems and sweet potato vines are fed. The mixed feed mentioned above is composed of kaoliang, beans and the like, mixed with cut straw or hay and water.

Although Shantung cattle may not be as good as Japanese cattle for beef, yet it is an established opinion that they are far better than Korean or Mongolian cattle. At the time of the German administration in Tsingtau efforts were made to improve the cattle. They always kept cattle of foreign breeds in their slaugther-house with which they undertook to better the Chinese cattle. Promising calves were purchased by the authorities. When they were one year old the German doctors brought them together, usually in the eight month of the lunar calendar, and held an exhibition of cows thus gathered. Prizes were awarded to good cows, which were later bred to cattle of foreign breeds. By means of such encouragement and others, the improvement of cattle in this district was induced.

§ 48. DESCRIPTION OF NATIVE "HUMPED" CATTLE.

The description of methods of caring for and feeding of the cattle in Shantung by the Japanese is the same as is generally followed in China. The feed, however, is different in different localitities. In the Canton region the grain fed is usually rice chop and wheat bran. The cattle in the Canton region are not as large as in Shantung, if the Japanese estimates are correct. The average cow in the south weighs 500 catties, and the average bull 600 catties, though some individuals have been noted that weigh as much as 1,000 catties when fat.

The native cattle of southern China, called the by Chinese "Wong Ngau" (yellow cow), are a humped species, scientifically known as *Bos Chinensis*. The main difference between these cattle and the European cattle, *Bos Taurus*, is in the enlargement or protuberance on the top of the shoulders. This prominence in the bulls sometimes is as much ten inches above the level of the back. The females, in the variety common in China, as a rule have only a small enlargement in this region. The meat in the hump is said to be of good quality.

The breeds of a closely related species in India, known as *Bos Indicus*, are further characterized by a heavy fold of skin which hangs liks a curtain from the throat to the brisket of the animal. The development of the hump and dewlop in the *Bos Chinensis* is about one half the development of the same in the *Bos Indicus* breeds.

The color of the native cattle in southern China is much like the color of Jerseys. It varies from a yellow red to a brown red and almost pure black color. Spotted or white cattle are not common, chiefly because the meat of an animal with color markings is considered inferior. Fawn is quite a common color. The nostrils are black with a grey or mealy colored ring around the muzzle just above the nostrils. The tongue is black. It is a peculiar coincidence that all of the above color characteristics of these cattle are also true of the Jerseys. While the amount of milk yielded is very small, so small that cows are seldom used for milking, the percentage of fat is quite high, varying from 5 to 8 percent., or somewhat higher than that of the Jerseys. The flavor of the milk is strong and not very palatable, which largely accounts for the fact that these cattle are very seldom used in southern China for milking.

Although the cattle are much alike in color and conformation, there are some differences in type in different communities.

§ 49. KINDS AND PRICES OF "HUMPED" CATTLE IN HONGKONG MARKETS

There are three distinct grades of catttle, for instance, that reach the Hongkong market, coming from different regions. Those coming from up the east coast of Kwangtung province from the region south of Swatow are far superior in size and beef characteristics to those raised in the region of Canton, and their dressed meat sells on the average for 27 cents local currency when Canton beef sells for 24 cents. Cattle from the West River region, or above Wuchow, are of a type just between the Canton and Swatow cattle. They are somewhat better than the Canton cattle, but not as good as those from the Swatow region. Cattle are sold by the head, and not weighed. The usual price for a fair individual weighing from 600 to 800 pounds is from Mex. $28 to Mex. $50.

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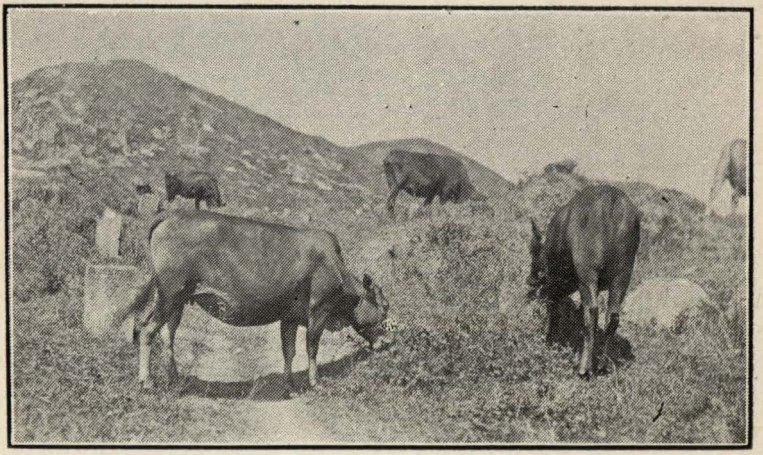
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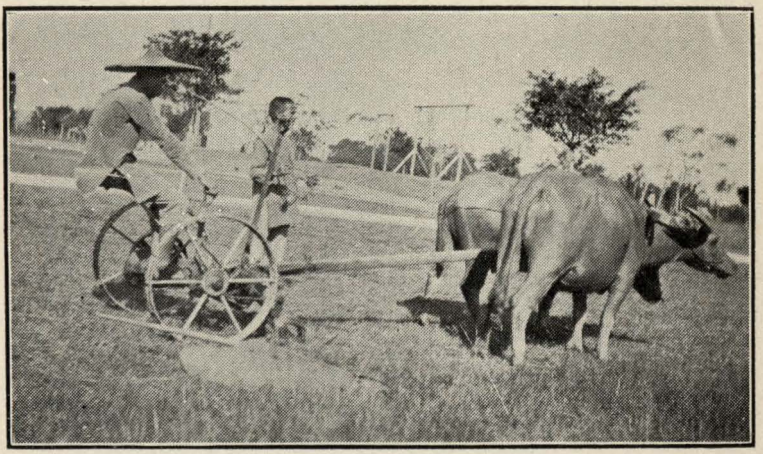
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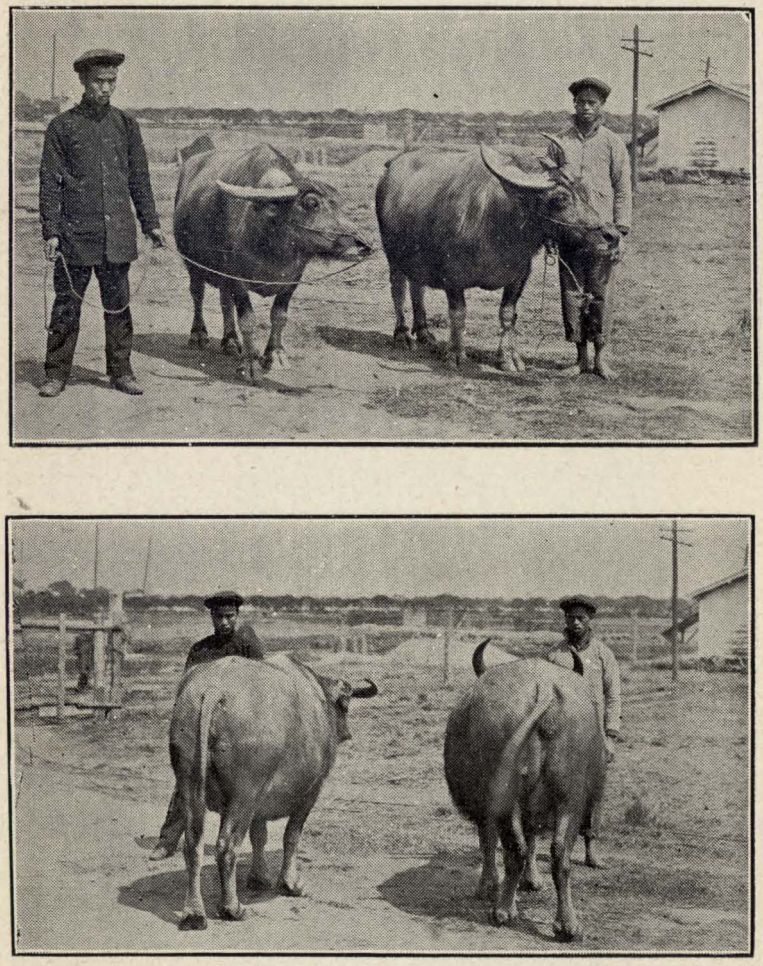
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NATIVE "HUMPED" CATTLE



WATER BUFFALO HITCHED TO A MCCORMICK MOWER
AS SEEN IN USE ON THE CAMPUS OF
CANTON CHRISTIAN COLLEGE



FRONT AND REAR VIEWS OF TWO WATER BUFFALO IN THE COLLEGE DAIRY HERD

Water Buffalo

§ 50. DESCRIPTION OF WATER BUFFALO

The water buffalo, *Bubalus bubalis*, is common in all parts of China as far north as Shanghai. It is most common in regions where low-land rice is the main crop grown by the farmers, where it finds its chief use as a draught animal in the wet paddy fields. The common weight (estimated) of the water buffalo in China is from 800 to 1,200 pounds. Measurements of twelve cows kept on the College farm have given an average height of 49 inches at the withers.

Like the pig, the water buffalo has no sweat glands in its skin, and for this reason cannot endure hard work in the sun for long without having its body wet with water. This accounts for the desire of the buffalo to wallow in mud or water. Animals are easily overcome by heat if worked hard in the sun, and sometimes go crazy and become very dangerous. Not infrequently such an animal has to be killed.

As a rule, the water buffalo is a gentle animal toward Orientals. Europeans, however, usually find the buffalo difficult to manage, and all attempts to raise the buffalo by Europeans have failed, except in Italy and some other places in southern Europe where it has been raised for centuries.

The horns of the buffalo are peculiar in shape. Those in China are large and much flattened, somewhat triangular at the base, deeply grooved on the upper surface, directed out and back from the head and finally curving inward. The length measured on the outside curve of the horn is usually a little more than two feet. In walking, the head is carried so that the face is almost level with the back. The tail is short, reaching to the hocks. The skin is a grey black, very thinly covered with grey-black hair, and has no oil or sweat glands. Lamson-Scribner* calls attention to the fact that the color of the water buffalo is not unlike that of the elephant, and their motions are similar. "The resemblence is so striking that a casual view of a moving herd of buffalos suggests a roving band of elephants."

*See Bailey: *Cyclopedia of American Agriculture*, vol. III, p. 292.

§ 51. OESTRUATION, GESTATION, WEIGHT OF CALVES AT BIRTH AND AGE OF USEFULNESS

Oestruation in the female buffalo as a rule does not occur until the heifer is two years old. It occurs one month after parturition, and reoccurs regularly every 28 to 30 days until the animal again becomes pregnant.

Definite records on the exact length of the gestation period with two cows only have been secured. In one case it was 310 and in the other it was 314 days.

Three calves from cows in the College dairy, weighed as soon after birth as they were dry, but before they had taken any food, averaged 67 pounds in weight. Their weights were: 64, 70, and 67 pounds.

In order to secure a long lactation period and the maximum of milk, buffalo cows kept for milk are usually not bred until three or four months after freshening. The cows are considered profitable for dairy purposes until they are about 15 years old.

§ 52. HOW TO TELL THE AGE OF A BUFFALO

The age of a buffalo is indicated quite accurately up to a certain number of years by the teeth, similar to the way age is indicated in European cattle. Like other members of the bovine group, the buffalo has no teeth in the front of the upper jaw. The calf is usually born with six temporary teeth in the front of the lower jaw. Two more appear a few weeks later. At about three years of age the middle pair of the temporary teeth are replaced by two permanent teeth. At four years the teeth on either side of the first pair are up and in use. At five years the next teeth on either side of the fourth year teeth are up, and at six years the corner teeth are up and in wear.

The age of animals more than six years old is roughly estimated by the appearance of the wearing surface of the teeth in the front of the lower jaw. In the younger animals the teeth have a sharp outer edge, the wearing surface slopes inward, and the teeth are somewhat angular. As the animals grow older the sharp edge of the teeth wear

down and the wearing surface becomes more flat and the teeth more round. At eight to ten years the enamel has worn away and yellow centers show on the wearing surface of each tooth.

§ 53. THE USES OF WATER BUFFALOS

Although in the past the principal use of the water buffalo has been for draught purposes in the rice fields, during recent years an increasing number is being used for dairy purposes. When the usefulness of the animals for work or dairy purposes is past they are slaughtered for beef.

§ 54. CHARACTER OF WATER BUFFALO MILK OTHER THAN THAT OF THE FAT CONTENT

The milk of the water buffalo is pure white in color. Butter made from the milk is also pure white. It is wholesome and palatable when produced under sanitary conditicns. Students and teachers (both Europeans and Chinese) prefer drinking buffalo milk to the European cow's milk at the Canton Christian College. The objectionable flavor often found associated with buffalo milk is usually due to the milk having been produced under unsanitary conditions. The fact that the buffalo has very little hair on its body, and the skin contains no oil or sweat glands, makes the problem of keeping the cows clean much easier that is the case with European cows.

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Milk Analysis and Records

§ 55. EXPLANATION OF MILK ANALYSIS AND RECORDS

The tables following this section give the analysis of milk and production records of cows for which we have records extending over a period of several months, or for entire lactation periods.

Butter fat analyses were made twice a month with a Babcock centrifugal tester. The milk for 24 hours was weighed twice a month. The average of the two tests was taken as the average test for the month. The average amount of milk for the two weighings was taken as the average daily production for the month.

The total solids (consisting of the fat, sugar, proteins and ash) were found by evaporating a weighed sample of milk in a steam bath until the weight become constant. The ash was determined by heating in a crucible over a gas flame until the weight became constant. The proteins were determined by the Kjeldahl method as described by Hawk.* The sugar was found by subtracting the sum of the ash, proteins, and fat from the total solids. The percentage in each case was found by dividing the weight of the final product by the weight of the sample of milk analyzed.

Analysis and records of buffalo milk are all of cows in the College dairy.

The buffalo cows were fed a grain ration consisting of two pounds wheat bran and one pound rice chop. Each cow was fed about a pound of this mixed feed a day for each pound of milk given daily. The rice was fed cooked. The grain was fed separately to each cow twice a day. About one and one-half ounces of salt was fed daily to the cows. The salt was mixed with the grain. About 40 pounds of water was mixed with the rice chop and bran at each feeding, making a very wet feed, the cows drinking it down rather than eating it. This is the usual method of feeding grain to cattle in China. Four times a day the cows were fed all they could consume of a mixture of green cut grass, which amounted to from 40 to 60 pounds a day per cow.

*Hawk, *Practical Physiological Chemistry* (5th ed.), pp. 483. See also Woodman, *Food Analysis*, pp. 25 and 117.

TABLE I.

§ 56. LENGTH OF LACTATION PERIOD, AMOUNT OF MILK AND FAT, AND PERCENTAGE OF FAT.

Number of Buffalo Cow	Length of Lactation Period (Months)	Total Amt. of Milk (Pounds)	Total Amt. of Fat (Pounds)	Average per cent. of Fat
2	8	1,081	120.05	11.80
4	11	1,332	168.31	12.63
5	Last 5 months only	575	75.58	13.12
7	Last 5 months only	425	58.88	13.82
8	Last 6 months only	363	56.16	15.48
51	11	2,671	257.46	9.65
53	First 7 months only	1,766	186.40	10.51
54	First 9 months only	2,242	263.15	12.13
55	9	1,852	219.61	11.86
60	First 6 months only	1,531	168.42	11.20

NOTES— No. 5 had been milking for 5 months when records began.
No. 7 had been milking for 8 months when records began.
No. 8 had been milking for 8 months when records begen.
No. 53 was giving 5 pounds, No. 54 was giving 9 pounds, and No. 60 was giving 8.2 pounds of milk a day, when the records closed for this bulletin.

TABLE II.

§ 57. COMPLETE ANALYSIS OF BUFFALO MILK

The samples analysed were composed of samples taken from twelve cows in the College dairy in November 1917. The milking in the morning was begun at four, and in the afternoon at two o'clock.

Sample Number	Percentage of Fat	Percentage of Ash	Percentage of Protein	Percentage of Sugar	Total Percentage of Solids	Percentage of Water
1 (M)	11.00	0.94	6.04	4.00	22.98	77.02
2 (A)	12.80	0.90	6.10	3.57	23.37	76.63
3 (A)	13.00	0.71	5.71	3.32	23.02	76.98
4 (A)	13.63	0.74	5.94	3.57	22.88	77.08
5 (A)	12.10	0.90	6.14	3.83	22.87	77.04
6 (A)	14.00	0.92	6.42	3.87	25.21	74.79
7 (M)	11.50	0.95	5.80	3.70	22.95	77.05
8 (M)	12.00	0.94	6.00	3.60	22.54	77.45
9 (M)	12.34	1.04	6.28	3.71	23.37	76.63
10 (M)	12.20	0.77	5.90	4.23	23.02	76.98
Averages	12.46	0.88	6.04	3.70	23.08	76.92

NOTES— (M) signifies Morning Milk
(A) signifies Afternoon Milk

TABLE III.

§ 58. COMPLETE ANALYSIS OF EUROPEAN COW'S MILK.

Sample Number	Percentage of Fat	Percentage of Ash	Percentage of Protein	Percentage of Sugar	Total Percentage of Solids	Percentage of Water
1	3.20	0.845	3.18	6.47	13.70	86.30
2	3.50	0.840	3.20	5.28	13.82	86.18
3	4.50	0.736	3.24	5.18	14.65	85.35
4	4.60	0.900	4.10	5.20	13.80	86.20
5	3.80	0.780	3.25	5.54	13.37	86.63
6	4.44	0.800	3.10	5.60	13.94	86.06
7	3.50	0.880	3.80	6.00	13.97	86.03
8	4.10	0.888	3.40	5.63	14.12	85.88
9	5.20	0.740	3.20	5.30	14.44	85.56
10	4.00	0.800	3 05	6.10	13.95	86.05
Averages	3.96	0.820	3.23	5.96	13.90	86.21

NOTES—

The analysis was made during January and February of 1917.

Samples 1 and 2 are of milk from the Hongkong Dairy Farm Co., in Victoria, Hongkong. The samples were taken from bottled milk from a herd of from 500 to 700 European cows, most of which are Holsteins. Samples 3, 4, 5, 6, and 7 are from the mixed milk of the Sinkee Dairy in Canton. In this dairy 90 to 100 foreign cows are kept, Guernsey and Shorthorn blood predominating.

Samples 8, 9, and 10, are from the mixed milk of four cows in the Canton Christian College Dairy. These four cows are of mixed breeding with Shorthorn blood predominating.

TABLE IV.

§ 59. Analyses of Canton Buffalo Milk and European Cow's Milk Compared

The percentage of fat represents the average of about 800 analyses, and the percentage of the other constituents represents the average of 10 analyses made by the writer.

	Canton Buffalo milk (per cent)	European cow's milk in Canton (per cent)	European cow's milk in America (per cent)
Fat	12.60	3.80	3.69
Proteins	6.04	3.23	3.53
Sugar	3.70	5.96	4.88
Ash	0.88	0.81	0.73
Total solids (including the fat, ash, protein and sugar)	23.20	13.80	12.83
Water	76.80	86.20	87.17

TABLE V.

§ 60. Analysis of Buffalo Milk in Southern China Compared with that in other Countries

	Southern China (per cent)	India* (per cent)	Philippine† Islands (per cent)	Italy* (per cent)
Fat	12.60	7.99	6.84	7.95
Protein	6.04	4.00	4.97	4.13
Sugar	3.70	5.18	5.16	4.75
Ash	0.86	0.78	0.83	0.97
Water	76.80	82.05	82.20	82.20

*Bailey, *Cyclopedia of American Agriculture*, vol. III, p. 295.

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Dairying in Southern China

§ 61. USE OF MILK IN CHINA

In the past the Chinese in China have not been consumers of milk, although in Mongolia and Tibet butter and milk have been used for food for centuries. Contact with the Europeans in recent years has taught the Chinese the value of this product as a food and in the larger cities there is an increasing demand for milk. According to old residents in Canton, 25 years ago there were no cows used for dairy purposes in that city. To-day there are about 600 cows of European breeds and 100 buffalo cows kept exclusively for milk. All the dairies in Canton are managed by Chinese, and their customers are practically all Chinese. In Hongkong there are several hundred cows kept for dairy purposes. Much condensed milk is imported also and used in China.

§ 62. EUROPEAN BREEDS IN CHINESE DAIRIES

Most of the European cows in the dairies of Canton and the Chinese dairies of Hongkong are of mixed breeding. All the dairy breeds, and the Shorthorns are represented. Shorthorn blood predominates. Blood of the other breeds ranks in the following order: Holstein, Guernsey, Ayrshire, and Jersey. The Hongkong Dairy Farm Co., under British ownership and management, has chiefly Holstein cows. This dairy has from 500 to 900 cows of dairy breeds, but no water buffalo.

§ 63. DAIRIES IN CANTON AND HONGKONG

There are twelve small dairies in Canton, each with from 5 to 20 cows, chiefly mixed dairy cattle, and a few water buffalos. The Sinkee Dairy (勝記牛奶公司), which at the present time is the largest, and also the most sanitary and best managed dairy in Canton, has from 90 to 100 European cows and from 5 to 10 buffalo cows. Three graded Guernsey bulls, one a very good individual, are at the head of this herd.

According to the manager of this dairy, the European cows give from 3,000 to 6,000 pounds of milk each lactation period. His buffalo cows give from 1,000 to 2,500 pounds. A large number of

analyses of buffalo milk from this herd made by the writer, has given an average of 12.5 per cent. fat.

In Victoria, Hongkong, there are about 25 small dairies chiefly of mixed European cows, selling milk to the public. The largest Chinese dairy is the Kowloon Dairy at Kowloon, near Victoria, Hongkong. This dairy, which is managed by Miss Mary Ahwee, is very sanitary, and all buildings are of the best construction for this climate, being large and roomy, with thick stone walls to keep out the excessive heat, and of sufficient ventilation. The floor is made of concrete.

The number of cows varies from 30 to 60. The cattle are always kept well groomed and no manure is allowed to collect in the barn. This herd is now headed by King Parthena Mead 221688, a promising three-years old bull, whose sire is King Mead of Riverside 50290, and dam is Parthena Agnes 2d 72583. The bull was purchased when a calf from W. A. Morris and Sons Corporation, Woodland, California.

The average production in this herd is about 18 pounds a day for a lactation period. Although there are no unusually high producing cows in this herd, they are big and strong looking cows. Most of the cows are graded Shorthorns. Two analyses of milk from this herd by the writer showed it to contain an average of 4 per cent. fat.

At the College, buffalo milk is sold for 20 cents and European cow's milk for 16 cents a pint. With European cow's milk selling for 16 cents, buffalo milk would be cheap at 30 cents. The demand at the College is chiefly for buffalo milk, not only because the College community has learned the food value of such milk, but because most of those who use milk prefer the flavor of buffalo milk to that of the European cow's milk.

In most of the dairies the milk is bottled for delivery, and is delivered morning and afternoon by carrying the bottles in two baskets on the ends of a pole, balanced at the middle on the shoulder of the carrier.

§ 64. THE BUFFALO COW AS A DAIRY ANIMAL

There are a number of commendable features in the use of the buffalo cow as a dairy animal. The amount of milk in the better buffalo cows of China* is not insignificant when we consider that there has been no breeding for production. Ordinary cows give more than 2,000 pounds of milk and 260 pounds of fat a year. The "Ram's Horn" buffalo from India rank with the best breeds of modern dairy cattle both in production of milk and butter fat.

The fact that the buffalo has no sweat or oil glands in the skin, makes it an easy animal to keep clean. The scant hair on the body affords a poor hiding place for lice, and it is easy to detect and get rid of such pests. The absence of tuberculosis among buffalos and their resistance to the tick fever adds to their value as dairy cows. The breeding of the native buffalo for production, and the importation of Indian dairy buffalos should be encouraged in every way possible, rather than to encourage the importation of European cows, because of the danger from tuberculosis in the European cows.

§ 65. OBJECTIONS TO THE BUFFALOS OF CHINA FOR DAIRY PURPOSES, AND HOW THESE OBJECTIONS MAY BE OVERCOME

The chief reason why so few buffalo cows are used for dairy purposes is no doubt because of the fact that they give but little milk, and that, while it contains about three and one-half times as much fat and nearly twice as much total solids as does European cow's milk, it usually sells for the same price as European cow's milk. However, as soon as the public appreciates the value of buffalo milk, it should command a much higher price than at present. Furthermore, the fact that cows which have not been bred especially for milk production, but simply selected from among ordinary buffalo cows, produce as much as 10 pounds of milk a day for several months, promises individuals giving a much larger amount of milk, after a few generations of selection and breeding for dairy purposes.

Buffalo cows need a bath twice a day in order to keep at their best. It is the custom for them to be driven to canals or ponds, for this wetting, in which the water is not always clean. To overcome

*See production tables, pp. 39-42 *supra*.

this objection tanks might be constructed in which clean water could be kept for their bath, or they may be wet by pouring clean water over them with buckets, or with a hose where water pressure can be secured.

§ 66. INDIAN DAIRY BUFFALOS

At Kowloon there is a herd of about twenty Indian buffalo cows managed by Indians. The buffalos in this herd have been imported from the region of Delhi, in the northern part of India. The buffalos are different from the Chinese buffalos. They are much larger, some of them being five feet tall at the withers. They have large spiral horns, and for this reason in the Philippine Islands, where they are being imported in large numbers for dairy purposes, they are known as the "Ram's Horn" buffalo. The milk, according to Dr. Gibson, contains about the same percentage of fat as the Chinese buffalo milk. They are said to give up to 60 pounds of milk a day in India on good feed. At the Indian dairy in Kowloon, when visited by the writer in January 1919, the average production in milk for twenty cows was about 15 pounds. The feed at that time consisted of dry rice straw for roughness, and a little cooked rice and wheat bran. The cows were crowded into a dark, poorly ventilated, and dirty barn, and were never brushed. It is the writer's opinion that with proper care and feed, the production of the cows in this herd could easily be doubled. The cows have a well developed mammary system with large teats.

§ 67. PRICES FOR AND DELIVERY OF MILK

Milk sells for from 12 cents to 18 cents a pint, local currency. The highest priced milk is sold by the more modern and sanitary dairies. The small, unsanitary dairies sell milk at the lowest prices. As a rule, buffalo and European cow's milk sell for the same price. This is because of the fact that people in general do not know of the greater amount of food value in buffalo milk.

It was found by Mr. Kwok I Sun, an agricultural student in the Canton Christian College, that most dairies that keep buffalo cows, in order to make their business pay, add water to the buffalo milk. The owners themselves admitted that one-third to one-half of the bulk was water that had been added. Analysis of such watered milk showed that it contained from 6 to 8.5 percent. fat.

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Common Diseases of Cattle and Water Buffalo

68. RINDERPEST

Among cattle and buffalo the most common disease is rinderpest, called by the farmers "ngau waan" (牛瘟). It is contagious. This disease causes millions of dollars of loss every year, as it did in the Philippines before compulsory vaccination of cattle with anti-rinderpest serum was adopted by the government of the Islands. The disease is somewhat like the chronic form of hog cholera in that it is usually accompanied with fever and causes lesions on the inner lining of the intestines. As with hog cholera, diarrhœa and running eyes are also common symptoms. It is not as fatal, however, as is cholera among the hogs.

§ 69. TICK FEVER

Tick fever, commonly known in the United States as Texas fever, after the region in which it is most common in the United States, is prevalent in South China. Native cattle are largely immune to the disease as they are in Texas and in India where the disease is common.

The disease is caused by a protozoan (*Piroplasma bigemina*) carried by a cattle tick (*Boophilus annulatus australis*), in a way similar to that by which malarial fever in man is caused by a protozoan injected into the body of man by the mosquito. The young ticks hatch from eggs laid in the grass where cattle graze. The small ticks emerge from the egg, crawl up the legs of cows and buffalos, and attach themselves to the body of the animal and begin sucking blood, remaining attached to the animal until they have grown to full size. The females, after having been fertilized by the males, drop to the ground and lay their eggs, from 1,500 to 3,000 each, which soon hatch and thus complete the life cycle. The disease is fatal to cattle imported from tick-free regions. Fortunately ticks do not travel far and live only in grass; cattle kept in barns and in dry lots are in little danger from the tick.

§ 70. TUBERCULOSIS

According to Dr. Heanley, of the Hongkong Bacteriological and Vaccine Laboratory, tuberculosis has never been found among the buffalo of south China and in 13 years of inspection of animals and carcasses in the Hongkong government slaughter house, where all animals slaughtered for food are inspected by government inspectors, only two cases in the humped cattle have come to notice. Both cases were bullocks. The disease is as common among European cattle as it is in America.

The Future for Live-Stock in China

§ 71. LAND AVAILABLE FOR FEED

The production of better and more live-stock must come as the country develops industrially and commercially. Good police protection, roads and railroads, a demand for export products and increasing demand for milk, will all be incentives to expansion of the live-stock industries. There is enough grass on the hills of China, now not being utilized except for fuel, to sustain at least twice as many cattle as is being produced fo-day.

Cattle sell for about one-half the price they sell for in America. Better prices offered for export beef, which will come with development, will stimulate the beef industry, and the demand for milk within China itself must be met. With the present prices received for milk (12 cents to 18 cents local currency per pound) and the price at which imported butter is sold ($1.20 per pound) there are few other industries that offer better opportunities for young men well trained in the principles of dairying and breeding and with a thorough knowledge of producing sanitary milk, butter, and other dairy products.

§ 72. IMPROVEMENT OF LIVE-STOCK

With the development of agricultural industries will come a demand for the improvement of different classes of live-stock now raised in China. Three methods of improvement suggest themselves.

First and no doubt foremost is improvement within the breed, without the introduction of foreign blood. A few generations of in-

telligent selection of individuals for breeding purposes would greatly improve the cattle for beef purposes. Because of the small amount of milk given by native humped cows, draught and beef production will probably always remain the function of this class of cattle. Breeding for improvement without introduction of foreign blood should be followed with all classes of live-stock, no matter how extensive the use of modern breeds may become.

The buffalo in China has been chiefly a draught animal, only to be used for beef after its usefulness for work is ended. Of recent years some dairies in Canton and Hongkong have begun to use the buffalo for milk and by selection and good feeding have now cows that give more than 12 pounds of milk a day, testing from 10 percent. to 15 percent. fat.

A second method of improvement is to introduce males of improved breeds for mating with native cows. Crossing the Berkshire breed of hogs with the native pigs in the Philippines has made a profitable hog out of the Island runt and would no doubt also improve the Chinese hog. In Hongkong the Mid-Yorkshire hog is proving a success both crossed with native hogs and when kept pure.

Crossing native cattle with modern breeds of beef cattle should doubtless improve the native cattle for beef purposes. However, such crossing of native humped breeds of cattle with European breeds has not proved popular in the Philippines nor in India, for the reason that while the cross produces better beef cattle, such cattle are of little use for draught. The chief reason why the native cattle are so well adapted to work is because of the hump against which the yoke fits so well. In animals containing foreign blood the hump is very small or not present at all.

A third method suggested for improvement of native live-stock is to secure pure-bred animals of desirable breeds and continue to breed them pure.

The first method suggested, that of selection within the native breed for improvement, is safest, but slow in bringing results. Introducing modern improved breeds will probably bring quicker results, provided only good, healthy individuals are secured and intelligent breeding is practised. However, the fact that disease common here

and not common in regions from which imported cattle come should be taken into consideration and this danger should be guarded against, or the result to individual breeders is apt to prove disastrous financially. Great care also should be exercised not to introduce tuberculosis along with European live-stock.

§ 73. NEED OF TRAINED LIVE-STOCK MEN AND VETERINARIANS

Men trained in animal breeding and feeding are much needed in China to improve the quality of live-stock by intelligent feeding, care, selection and breeding and by introduction of foreign breeds. Veterinarians are needed to take up a thorough study of diseases and their control, and to build up laboratories for the produciong of anti-cholera and anti-rinderpest serums as measures toward the prevention of these two great plagues of the live-stock industry. Canton needs government live-stock sanitary inspectors and adequate laws to support them, to prevent the sale of diseased meat, and above all the sale of unwholesome milk; for while the danger of eating diseased meat is serious enough, the danger of contracting typhoid fever, tuberculosis, and other diseases from contaminated milk is apparent to all. Every cow with European blood whose milk is being sold to the public should be tested for tuberculosis and reacting animals be rejected as dairy animals. Such work is the work of a veterinarian. It would not be necessary to test native cows or buffalos as they are apparently highly resistant if not immune to the disease.

One has but to visit the dairies in Canton, with the possible exception of the Sinkee Dairy, and to note the animals kept for milk, and the unsanitary conditions under which milk is produced, to realize the need of veterinary and sanitary inspections and authority to compel the production of clean milk.

Some of the dairies have good bulls of modern dairy breeds, but can not produce good milkers because of their methods of raising calves. From the time the calves are born they are kept tied up in a barn and are never turned out to exercise even in a day lot. Naturally the cows in even the best dairies are poor milk cows, small in size, and some with every indication of tuberculosis, and giving an average

of from fifteen to twenty pounds a day of what is very probably contaminated milk, while if properly cared for they might give from thirty to forty pounds of good, wholesome milk.

§ 74. STANDARDIZING MILK

Many dairies in Canton at present add water to the milk sold in order to increase their profits. The danger to the consumer of disease germs from impure water used is apparent, to say nothing of the unfairness to honest dairymen. Milk put on sale by the Canton dairies shouid be analyzed with a Babcock tester for fat and a check be kept on watering milk. Buffalo milk containing less than 10 percent. fat and European cows milk containing less than 3 percent. fat is undoubtedly watered milk, and dairymen found guilty of watering should be heavily fined. Repetition of the offence should cancel the right of such a dairy to sell milk to the public. Buffalo milk should be sold for at least twice as much as foreign cow's milk in order to remove the temptation to water such milk. It would, at such a price, be no higher in price for the food value it contains than foreign cow's milk.

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